

## **ANALYSIS OF GROUND WATER IN AND AROUND KOLLIDAM AREA FOR IRRIGATION PURPOSES**

**Dr. R. Mathiyazhagan<sup>1</sup>, Dr. T. Ramesh<sup>1</sup>, Dr. R. Sheela<sup>1\*</sup>, and Dr. R. Rajendran<sup>2</sup>**

<sup>1</sup> Assistant Professor, Department of Civil Engineering, Annamalai University, Annamalai Nagar,  
Chidambaram, Tamil Nadu, India.

<sup>2</sup> Assistant Professor, Department of Sociology, Annamalai University, Annamalai Nagar,  
Chidambaram, Tamil Nadu, India.

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### **ABSTRACT**

Water is referred to as universal solvent, since among all the importance needs of human beings and animals and universally known as air, water food, shelter etc, water plays a very important role and it is the highest role because it is essential to sustain life since the protoplasm of many living cells contain 30% of water and any substantial reduction will cause disaster. The main objective of the study is to determine the ground water quality in and around Kollidam area. The study reveals that the characteristics of ground water in and around Kollidam area are not having wide variation with Indian standards. The reason may become of the natural drain (Kollidam River) flows along the peripheral of the study area.

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## **INTRODUCTION**

### **1.1. General**

Water is referred to as universal solvent, since among all the importance needs of human beings and animals and universally known as air, water food, shelter etc, water plays a very important role and it is the highest role because it is essential to sustain life since the protoplasm of many living cells contain 30% of water and any substantial reduction will cause disaster. Water is required for satisfactory performance of physiological organisms, as the circulatory fluid, as a carrier of nourishing food and for the removal of products of water. It is noted and found that two third of the human body consists of water. Water is used by man for variety of purpose such as drinking, bathing, washing, laundry, cleaning, heating, air conditioning, irrigation, gardening, industrial processing, power generation, fire fighting, water disposal, fishery, swimming, boating and other recreational

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\* **Corresponding Author:** Dr. R. Sheela, [sheelaragu2015@gmail.com](mailto:sheelaragu2015@gmail.com)

purpose etc. When compared to all other minerals available on earth, the ground water serves to be precious distributed resources of the earth. At Present nearly one fifth of all the water used is obtained from ground water nearly 80% of the consumption of water is used for agricultural purpose. Not only for agriculture, when considering the all animals, fisheries, need abundant quantity of water. About 40% of ground water is used for irrigational purposes. The ground water available in most of the inhabited areas is of potable quality and free from pollutants and evaporation losses. The aim of this study is to access any variation in physical and chemical constituents of underground water available by all means of comparing the test results of twenty number of bore wells obtained with the standards.

### 1.2 Importance of Ground Water

Ground water IS commonly understood to mean water occupying all voids within the geological stratum and the water that occurs below the earth. This saturated zone is to be different from an unsaturated or zone of aeration where voids are filled with water and air is a saturated zone, and is important for engineering works, geological studies and water supply developments. Unsaturated zones are usually found above saturated zones and extend upwards to the ground surface because water includes soil moisture within the root zones it is of major concern of agriculture, botany and soil science, No rigid demarcation of water between the zones is possible for the posses and inter dependant boundary and water can move from one zone to other zone in either direction. Ground water plays an important role in petroleum engineering, two fluid system involving oil and water, three fluid system involving gas, oil, water, occur frequently in development of petroleum industries. Several of earth science including geology, hydrology, meteorology, oceanography concerned with ground water.

### 1.3. Formation of Ground Water

Ground water occurs in permeable geological formation known as aquifers. Those portions of rock are soil, which is not occupied by mineral matter, may be occupied by ground water. These spaces are known as voids. Interstices, pores are pore spaces. Ground water is the water formed from absorbed precipitated water in the upper most aquifers occurring in subsoil or in deeper bed rocks above the upper most aquifers. Rock formation material which wills yields significant quantities of water has been defined as aquifers. It plays a very important part in the ground water.

**Figure – 1:** *Formation of Ground Water*

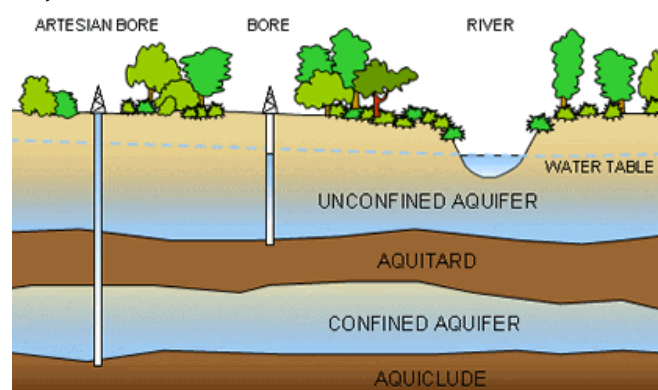
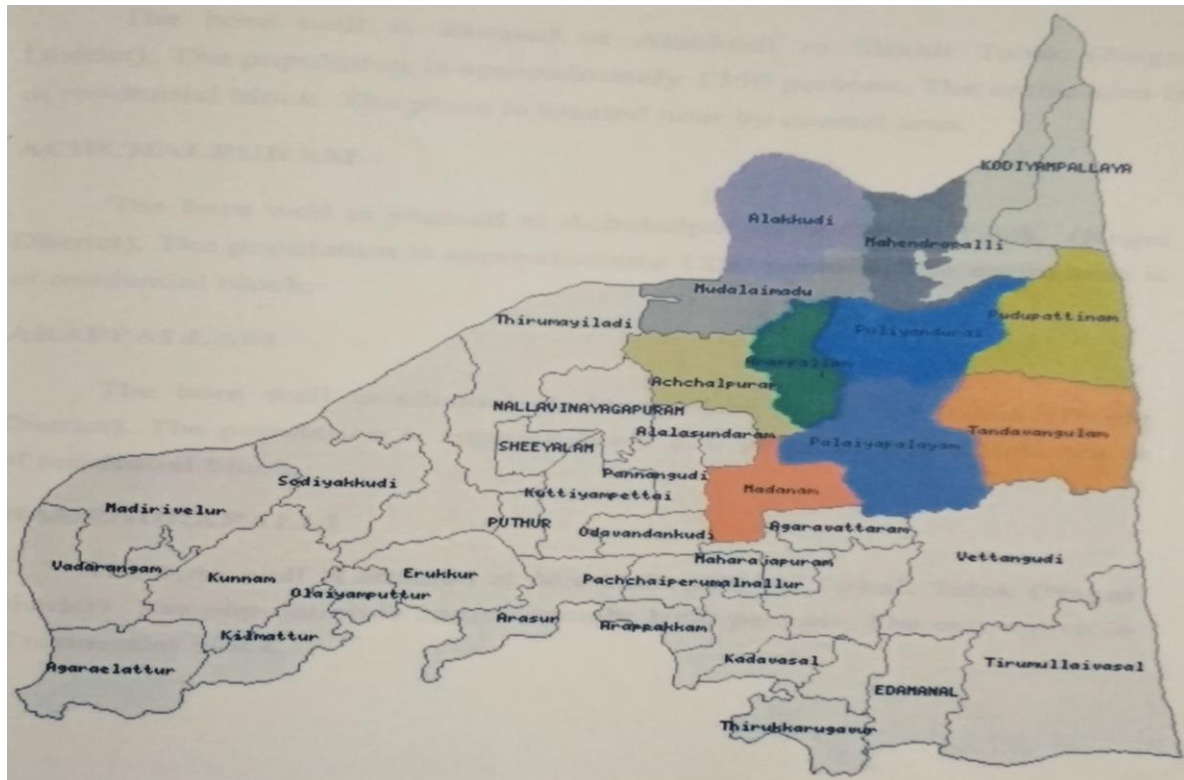


Figure 1 shows the typical cross section of the earth crust showing the occurrence of the ground water in a confined and an unconfined aquifers. Formation which contains ground water on the same line which all sufficient permeable to transmit and yield water in usable quantities is called aquifers.

## STUDY AREA

**Figure – 2:** *Study Area Map*



### 2.1 Mudalaimadu

The bore well is situated at Mudalaimadu in Sirkali Taluk (Nagai District). The population is approximately 950 persons. The entire area is of residential block. The place is located near by coastal area.

### 2.2 Alakkudi

The bore well is situated at Alakkudi in Sirkali Taluk (Nagai District). The Population is approximately 1350 persons. The entire area is of residential block. The place is located near by coastal area.

### 2.3 Achchalpuram

The bore well is situated at Achchalpuram in Sirkali Taluk (Nagai District). The population is approximately 1250 persons. The entire area is of residential block.

### 2.4 Arappallam

The bore well is situated at Arappallam in Sirkali Taluk (Nagai District). The population is approximately 850 persons. The entire area is of residential block.

## **2.5 Mahendrapalli**

The bore well is situated at Mahendrapalli in Sirkali Taluk (Nagai District). The population is approximately 1000 persons. The entire area is of residential block.

## **2.6 Puliandurai**

The bore Well IS Situated at Puliandurai in Sirkali Taluk (Nagai District). The population is approximately 1350 persons. The entire area is of residential block.

## **2.7 Pudupattinam**

The bore well is situated at Pudupattinam in Sirkali Taluk (Nagai District). The population is approximately 1200 persons. The entire area is of residential block.

## **2.8 Palaiyapalayam**

The bore well is situated at Palaiyapalayam in Sirkali Taluk (Nagai District). The population is approximately 1050 persons. The entire area is of residential block.

## **2.9 Tandavangulam**

The bore well is situated at Tandavangulam in Sirkali Taluk (Nagai District). The population is approximately 1000 persons. The entire area is of residential block.

## **2.10 Madanam**

The bore well is situated at Madanam in Sirkali Taluk (Nagai District). The population is approximately 1150 persons. The entire area is of residential block.

## **MATERIALS AND METHODS**

The water samples were collected using sample collecting bottles. The sample bottles were rinsed with the distilled water to avoid contamination. While collecting water sample in shallow depth, the mouth of the bottle was tightly covered with the cap and submerge the bottle to the desired depth and remove cap to allow of water to enter the bottle. Squeeze the bottle or tap the sides to dislodge any air bubbles clinging insides of the bottle. Replace the cap while the bottle is till under water. After bringing the bottle to the surface, complete examine it to be certain that no air bubbles are present in the sample. No air should be introduced with the reagents are added by allowing the drops to fall into the test sample, because of the greater density of the reagents, they will quickly descend into the sample. After each addition of reagents the bottle is carefully capped for mixing, making sure that no air bubbles are formed. The sample for analysis of underground water from Twenty Number of deep bore wells around in kollidam areas. Before collecting the samples the instructions are followed as mentioned above. These samples are collected in the one liters bottles with air tight caps and sealed it. After taking samples, mentioned the date of sampling and location of bore well details etc. The collected samples were tested in environmental laboratory and advanced environmental laboratory, Department of Civil Engineering, Annamalai University. Water samples were collected from twenty number of bore wells in different localities and the physical and chemical analysis were carried out and tabulated.

**RESULTS & DISCUSSION**

Water samples collected from twenty number of bore wells in different locations in and around Kollidam area were tested. The results obtained as compared with the Indian Standards were established as follows. The table shows the permissible limits obtained values and remarks based on the comparison with standards.

**Table – 1:** *Sample No: 1; Location: Kuthavakarai; Village: Alakudi; Depth: 6m**Date of Collection: 24/02/2012*

Parameters Analysed	Sample Test Results	Remarks
Electrical Conductivity (Mg/l)	1805	Normal
Total Dissolved solids (mg/lit)	1173	Normal
Chloride as Cl (ppm)	450	Normal
Sulphate SO <sub>4</sub> (ppm)	90	Normal

**Table – 2:** *Sample No: 2; Location: Achankadu; Village: Alakudi; Depth: 4.5m**Date of Collection: 24/02/2012*

Parameters Analysed	Sample test Results	Remarks
Electrical Conductivity (Mg/l)	505	Normal
Total Dissolved solids (mg/lit)	328	Normal
Chloride as Cl (ppm)	220	Normal
Sulphate SO <sub>4</sub> (ppm)	18	Normal

**Table – 3:** *Sample No: 3; Location: Bus Stand; Village: Mahendrapalli; Depth: 5 m**Date of Collection: 24/02/2012*

Parameters Analysed	Sample Test Results	Remarks
Electrical Conductivity (Mg/l)	2758	Exceeded
Total Dissolved solids (mg/lit)	580	Normal
Chloride as Cl (ppm)	833	Normal
Sulphate SO <sub>4</sub> (ppm)	3	Normal

**Table – 4:** *Sample No: 4; Location: Main Road; Village: Mahendrapalli; Depth: 20m**Date of Collection: 24/02/2012*

Parameters Analysed	Sample Test Results	Remarks
PH	8.15	Normal
Electrical Conductivity (Mg/l)	585	Normal
Total Dissolved solids (mg/lit)	380	Normal
Chloride as Cl (ppm)	108	Normal
Sulphate SO <sub>4</sub> (ppm)	7	Normal

**Table – 5:** Sample No: 5; Location: Periyar Street; Village: Puliandurai; Depth: 4.5 m

Date of Collection: 25/02/2012

Parameters Analysed	Sample Test Results	Remarks
PH	7.48	Normal
Electrical Conductivity (Mg/l)	735	Normal
Total Dissolved solids (mg/lit)	477	Normal
Chloride as Cl (ppm)	230	Normal
Sulphate SO <sub>4</sub> (ppm)	15	Normal

**Table – 6:** Sample No: 6; Location: Kovilmedu Street; Village: Puliandurai; Depth: 6m

Date of Collection: 25/02/2012

Parameters Analysed	Sample Test Results	Remarks
PH	7.41	Normal
Electrical Conductivity (Mg/l)	1022	Normal
Total Dissolved solids (mg/lit)	624	Normal
Chloride as Cl (ppm)	250	Normal
Sulphate SO <sub>4</sub> (ppm)	19	Normal

**Table – 7:** Sample No: 7 Location: Pullaiyar Koil Street; Village: Pudhupattinam; Depth: 3m

Date of Collection: 25/02/2012

Parameters Analysed	Sample Test Results	Remarks
PH	7.62	Normal
Electrical Conductivity (Mg/l)	1677	Normal
Total Dissolved solids (mg/lit)	1090	Normal
Chloride as Cl (ppm)	340	Normal
Sulphate SO <sub>4</sub> (ppm)	33	Normal

**Table – 8:** Sample No: 8; Location: Duriath Amman Street; Village: Pudhupattinam; Depth: 4.5m

Date of Collection: 25/02/2012

Parameters Analysed	Sample Test Results	Remarks
PH	7.71	Normal
Electrical Conductivity (Mg/l)	1977	Normal
Total Dissolved solids (mg/lit)	368	Normal
Chloride as Cl (ppm)	470	Normal
Sulphate SO <sub>4</sub> (ppm)	66	Normal



**Table – 9:** Sample No: 9; Location: Main Road; Village: Thandavangulam; Depth: 3.5m

Date of Collection: 26/02/2012

Parameters Analysed	Sample Test Results	Remarks
PH	7.62	Normal
Electrical Conductivity (Mg/l)	1258	Normal
Total Dissolved solids (mg/lit)	802	Normal
Chloride as Cl (ppm)	430	Normal
Sulphate SO <sub>4</sub> (ppm)	12	Normal

**Table – 10:** Sample No: 10; Location: Anna Nagar; Village: Thandavangulam; Depth: 4.5m

Date of Collection: 26/02/2012

Parameters Analysed	Sample Test Results	Remarks
PH	7.35	Normal
Electrical Conductivity (Mg/l)	1370	Normal
Total Dissolved solids (mg/lit)	880	Normal
Chloride as Cl (ppm)	365	Normal
Sulphate SO <sub>4</sub> (ppm)	32	Normal

**Table – 11:** Sample No: 11; Location: Sannathi Street; Village: Palaiyapalayam; Depth: 5m

Date of Collection: 26/02/2012

Parameters Analysed	Sample Test Results	Remarks
PH	7.41	Normal
Electrical Conductivity (Mg/l)	1428	Normal
Total Dissolved solids (mg/lit)	917	Normal
Chloride as Cl (ppm)	380	Normal
Sulphate SO <sub>4</sub> (ppm)	36	Normal

**Table – 12:** Sample No: 12; Location: School Street; Village: Palaiyapalayam; Depth: 6m

Date of Collection: 26/02/2012

Parameters Analysed	Sample Test Results	Remarks
PH	7.18	Normal
Electrical Conductivity (Mg/l)	1550	Normal
Total Dissolved solids (mg/lit)	1007	Normal
Chloride as Cl (ppm)	328	Normal
Sulphate SO <sub>4</sub> (ppm)	57	Normal

**Table – 13:** Sample No: 13; Location: Main Road; Village: Madanam; Depth: 8m

Date of Collection: 27/02/2012

Parameters Analysed	Sample Test Results	Remarks
PH	7.36	Normal
Electrical Conductivity (Mg/l)	480	Normal
Total Dissolved solids (mg/lit)	306	Normal
Chloride as Cl (ppm)	170	Normal
Sulphate SO <sub>4</sub> (ppm)	10	Normal

**Table – 14:** Sample No: 14; Location: Serukudi Street; Village: Madanam; Depth: 7m

Date of Collection: 27/02/2012

Parameters Analysed	Sample Test Results	Remarks
PH	7.16	Normal
Electrical Conductivity (Mg/l)	1684	Normal
Total Dissolved solids (mg/lit)	1087	Normal
Chloride as Cl (ppm)	345	Normal
Sulphate SO <sub>4</sub> (ppm)	42	Normal

**Table – 15:** Sample No: 15; Location: School Street; Village: Mudalaimeedu; Depth: 6m

Date of Collection: 27/02/2012

Parameters Analysed	Sample Test Results	Remarks
PH	7.10	Normal
Electrical Conductivity (Mg/l)	1298	Normal
Total Dissolved solids (mg/lit)	837	Normal
Chloride as Cl (ppm)	420	Normal
Sulphate SO <sub>4</sub> (ppm)	3	Normal

**Table – 16:** Sample No: 16; Location: Thoppu Street; Village: Mudalaimeedu; Depth: 6.5m

Date of Collection: 27/02/2012

Parameters Analysed	Sample Test Results	Remarks
PH	7.00	Normal
Electrical Conductivity (Mg/l)	2600	Exceeded
Total Dissolved solids (mg/lit)	650	Normal
Chloride as Cl (ppm)	610	Normal
Sulphate SO <sub>4</sub> (ppm)	18	Normal



**Table – 17:** *Sample No: 17; Location: Main Road; Village: Achchalpuram; Depth: 6m*

*Date of Collection: 28/02/2012*

Parameters Analysed	Sample Test Results	Remarks
PH	7.10	Normal
Electrical Conductivity (Mg/l)	662	Normal
Total Dissolved solids (mg/lit)	498	Normal
Chloride as Cl (ppm)	150	Normal
Sulphate SO <sub>4</sub> (ppm)	13	Normal

**Table – 18:** *Sample No: 18; Location: Sannathi Street; Village: Achchalpuram; Depth: 6m*

*Date of Collection: 28/02/2012*

Parameters Analysed	Sample Test Results	Remarks
PH	7.00	Normal
Electrical Conductivity (Mg/l)	615	Normal
Total Dissolved solids (mg/lit)	396	Normal
Chloride as Cl (ppm)	160	Normal
Sulphate SO <sub>4</sub> (ppm)	11	Normal

**Table – 19:** *Sample No: 19; Location: South Street; Village: Arapallam; Depth: 6m*

*Date of Collection: 28/02/2012*

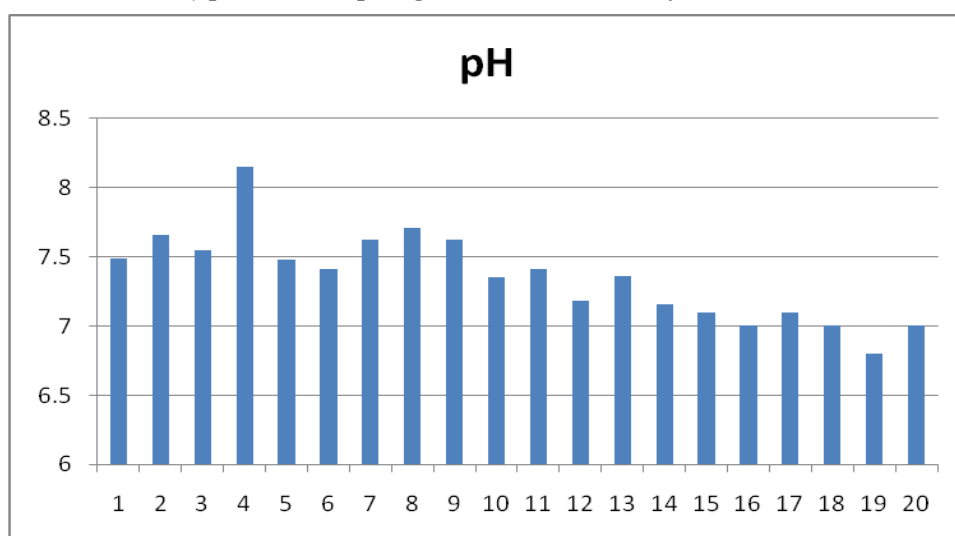
Parameters Analysed	Sample Test Results	Remarks
PH	6.8	Normal
Electrical Conductivity (Mg/l)	1272	Normal
Total Dissolved solids (mg/lit)	768	Normal
Chloride as Cl (ppm)	450	Normal
Sulphate SO <sub>4</sub> (ppm)	24	Normal

**Table – 20:** *Sample No: 20; Location: West Street; Village: Arapallam; Depth: 6.5m*

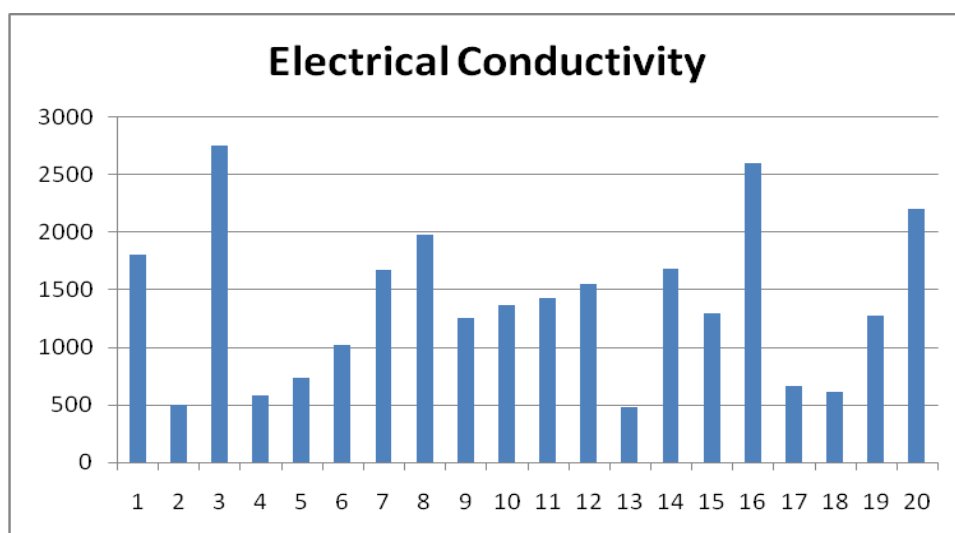
*Date of Collection: 28/02/2012*

Parameters Analysed	Sample Test Results	Remarks
PH	7	Normal
Electrical Conductivity (Mg/l)	2205	Exceeded
Total Dissolved solids (mg/lit)	1277	Normal
Chloride as Cl (ppm)	580	Normal
Sulphate SO <sub>4</sub> (ppm)	26	Normal

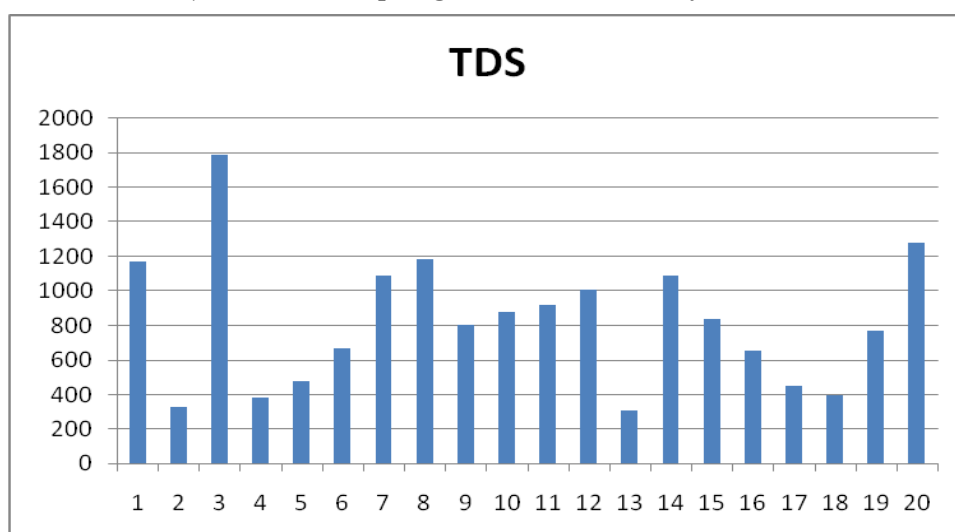
**Figure – 3:** *Variations of pH in Sampling Wells in the Study Area*



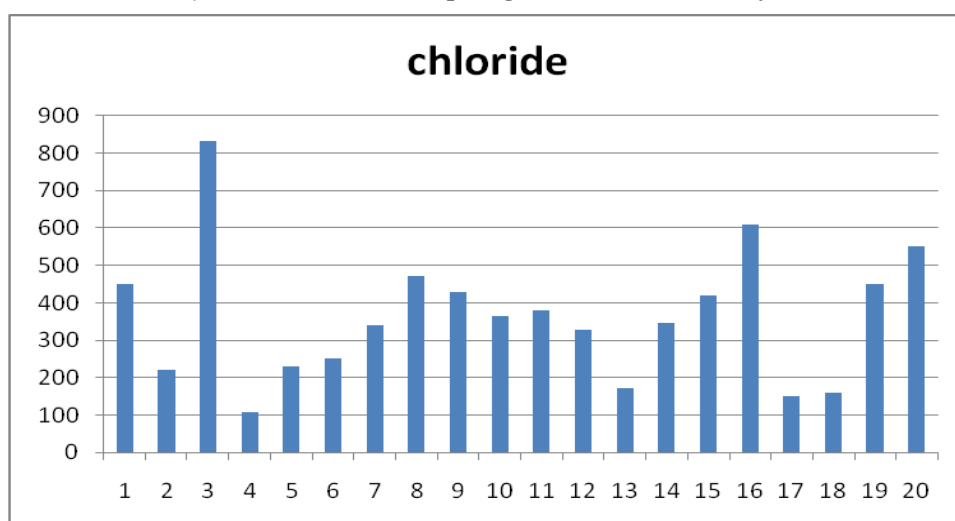
**Figure – 4:** *Variations of EC in Sampling Wells in the Study Area*



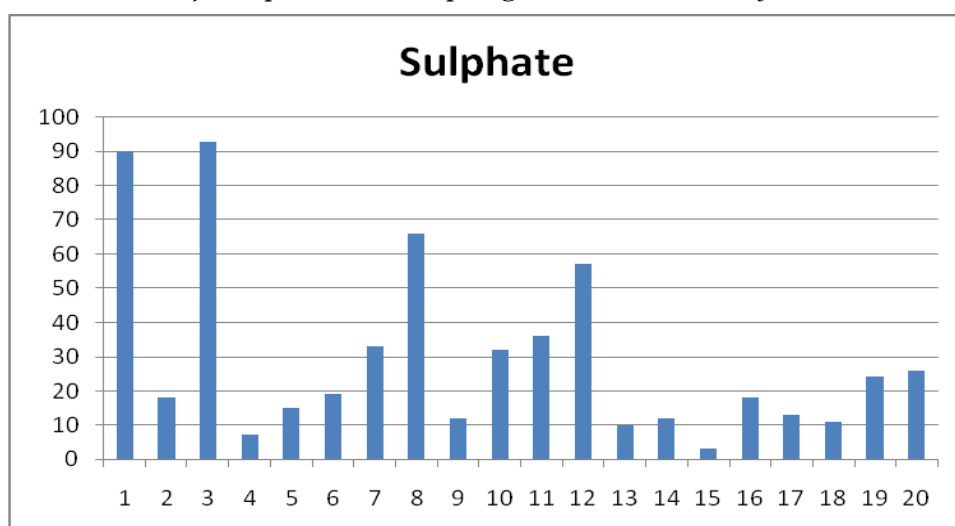
**Figure – 5:** *Variations of TDS in Sampling Wells in the Study Area*



**Figure – 6:** *Variations of Chlorides in Sampling Wells in the Study Area*



**Figure – 7:** *Variations of Sulphate in Sampling Wells in the Study Area*



The water quality standards for irrigation purposes is shown in Table 21.

**Table – 21:** *Indian Water Quality Standards for Irrigation Purposes*

Characteristics	E
Dissolved Oxygen (DO)mg/l, min	-
Biochemical Oxygen demand (BOD)mg/l, max	-
Total coliform organisms MPN/100ml, max	-
pH value	6.0-8.5
Colour, Hazen units, max.	-
Odour	-
Taste	-
Total dissolved solids, mg/l, max.	2,100
Total hardness (as CaCO <sub>3</sub> ), mg/l, max.	-

Calcium hardness (as CaCO <sub>3</sub> ), mg/l, max.	-
Magnesium hardness (as CaCO <sub>3</sub> ), mg/l, max.	-
Copper (as Cu), mg/l, max.	-
Iron (as Fe), mg/l, max.	-
Manganese (as Mn), mg/l, max.	-
Chlorides (as Cl), mg/l, max.	600
Sulphates (as SO <sub>4</sub> ), mg/l, max.	1,000
Nitrates (as NO <sub>3</sub> ), mg/l, max.	-
Fluorides (as F), mg/l, max.	-
Phenolic compounds (as C <sub>2</sub> H <sub>5</sub> OH), mg/l, max.	-
Mercury (as Hg), mg/l, max.	-
Cadmium (as Cd), mg/l, max.	-
Selenium (as Se), mg/l, max.	-
Arsenic (as As), mg/l, max.	-
Cyanide (as CN), mg/l, max.	-
Lead (as Pb), mg/l, max.	-
Zinc (as Zn), mg/l, max.	-
Chromium (as Cr <sup>6+</sup> ), mg/l, max.	-
Anionic detergents (as MBAS), mg/l, max.	-
Barium (as Ba), mg/l, max.	-
Free Ammonia (as N), mg/l, max	-
Electrical conductivity, micromhos/cm, max	2,250
Sodium absorption ratio, max	26
Boron, mg/l, max	2

**Table – 22:** *Guidelines for Evaluation of Irrigation Water Quality*

Water Class	SODIUM (NA) %	Electrical Conductivity ( $\mu$ S/cm)	SAR	RSC MEQ/L
Excellent	< 20	< 250	< 10	< 1.25
Good	20 - 40	250 – 750	10 – 18	1.25 – 2.0
Medium	40 - 60	750 – 2,250	18 – 26	2.0 – 2.5
Bad	60 – 80	2,250 – 4,000	> 26	2.5 – 3.0
Very Bad	> 80	> 4,000	> 26	> 3.0

## CONCLUSION

The physical and chemical properties of underground water vary with time, due to factors like climate, geologic, hydrologic, ecological and biogenetic factors. It also Vary due to artificial factors such as irrigation, reservoir etc. to ascertain the above phenomenon, in this study, the underground water in 20 bore wells situated in and around Kollidam were analysed. The results obtained from Electrical Conductivity test shown that except Mahendrapalli, Mudalimedu and Arappallam, all other sampling wells recorded the lesser than the maximum EC values. This study concluded that the physical & chemical properties of underground water in the three villages were exceed the Indian water quality standards for irrigation purposes.

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